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AUTHOR Nadel, Edward
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ABSTRACT

Prepared as an introduction to the methods and techniques of citation and co-citation analysis for educational researchers, this paper describes a citation database which was extracted from educational research periodicals and explores in a preliminary manner the results of a a citation analysis of the database. The analytical procedures involved in gathering citation and co-citation data are discussed, and the use of cluster analysis of citation data is outlined as a means of identifying the intellectual structure of education-related specialties. An intellectual map of the field of reading research, based upon a citation and cluster analysis of the relevant literature, is then discussed, together with less detailed intellectual maps of three reading-related specialties--question insertion and text comprehension, word perception and cognition, and dialect in reading. Accompanying the text are a reference list, a list of the 182 journals included in the educational database, and a set of eight figures illustrating citation and cluster analysis of the literature discussed. (Author/JL)

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EXPLORATION OF READING CLUSTERS IN THE EDUCATION LITERATURE 1974 - 1978

by Edward Nadel, Ph.D.
Institute for Scientific Information

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The purpose of this paper is to introduce educational researchers to the methods and techniques of citation and co-citation analysis; to describe a special database of the educational literature that has been extracted under contract for the National Institute of Education and to explore in a very preliminary manner some of the substantive results of the co-citation analysis of this database. My own background is in the sociology and philosophy of science, so I do not claim any depth of understanding of the education or reading literatures. Rather, my goal here is to engage the interest of educational researchers in analyzing this database in depth and show the applicability of this data to their research interests

We start with the difference between citation and co-citation data. A citation is a reference in a journal article. For a given number of such articles published in a specific time frame, references can be ranked by the number of citations they receive. The population of source articles which generates the references is usually defined in terms of a common subject matter, for example, the education literature. The articles most highly cited in a given literature, during a specific time period, will indicate the most widely used and generally the most intellectually important literature (Cole & Cole: 1973) in the overall subject area. Changes in the list of highly cited articles overtime can indicate changes in the overall intellectual direction of the field and also changes in the methodological techniques employed in the field. Moreover, using the cited journal rather than the cited article as a unit of analysis, the intellectual relationship between the field's journals can be specified. The use of citation analysis and bibliometric measures in general is not unknown to the education literature (see, for example, Smart and Elton, 1981). Bibliometric measures have also been shown to be highly correlated with other cognitive variables such as a subjective ranking of academic departments (Drew and Karpf-1981). Citation variables, therefore, hold promise of updating such cognitive variables without the use of costly survey techniques.

Note, however, that any conclusions drawn from citation or bibliometric data depends on how the population universe of citing articles is defined. If

a specialty, for example--reading, has a large literature relative to other specialties in the field (education), then its specialized references will be cited frequently relative to the other specialties. If, on the other hand, a specialty is relatively small, its cited references will appear lower in the ranking. This also applies to important articles of the problem areas within specialties. Problem areas may generate few new articles every year. Their specialized references will therefore receive even fewer citations. Hence, one has to be careful in generalizing about intellectual importance from citation rankings. One makes the assumption of a common subject focus of the population of citing articles.

What is there to do then if one is interested in the problem areas or specialties of a larger literature? One thing we can do is to define a subpopulation of citing articles confined to the specialty or problem area of interest. But here one has to devise a methodology to extract the subpopulation of articles. Expert opinion may be able to select out the citing articles of interest, but this is fatiguing with literatures running into hundreds or thousands of articles. An alternative method is a "bootstrap" approach and allows articles to sort themselves out. In order to do this, we turn from citation to co-citation analysis.

A co-citation occurs when a reference to two articles appears in the same citing article. Co-citation, the frequency of co-occurance, can be counted for each pair of references. The assumption behind co-citation analysis is the following: References that frequently appear together in the same citing articles have an intellectual relationship between them. The frequency of co-citation can be used to compute a measure of association or distance between the references. Multivariate statistics based on metric or non-metric assumptions can be used to group cited articles by their co-citations. Cluster analysis, first adopted by Henry Small (1977) at ISI, has been widely used in analyzing co-citation data.

Articles grouped by co-citation into clusters have been shown (Small, 1977) to center around a common subject area usually of problem area or specialty area size. Each cluster contains a set of citing articles and a set of cited articles. The relationship between cited articles, a measure of cognitive structure, can be depicted spacially using MD-scale mapping. The clusters, thus, partition the database into small units based on subject matter. As the time periods change and one set of citing articles replaces another set, the change of intellectual direction in cognivive relationships between cited articles can be observed for a specialty

With this in mind we can proceed to discuss the education citation file created for NIE and the analysis and indexes based upon it. It was NIE's intention to facilitate the use of bibliometric data in studying educational research by creating a special database of educational journals together with the journals from other fields, like psychology, sociology, and political science, that contain education related research. NIE selected 182 journals from the years 1974--1978 for this database. (Figure 1). Most of these journals were already contained in the Social Science Citation Index or the Science Citation Index. However, seventeen of the smaller education journals had to be specially added to the database for this project. Of the 182, 98 were clearly specialty journals in education. This can be observed by scanning the list. Most of the noneducation journals are from psychology. The logic behind this selection is understandable given the strong emphasis of child and developmental psychology on learning processes. But the above discussion of the definition of the citing article universe should be kept in mind when interpreting the source journal list. A Journal Citation Report (JCR) was constructed in the same format as the SCI and SSCI JCR's. Journals were ranked by their number of source articles and the number of citations they received. Also of interest are the citing and cited detailed packages where individual journals are analyzed in terms of which journals cite them most frequently and to which journals they devote their own references. From such data, influence flows can be mapped. Do education journals, for example, devote more of

their references to psychology journals and visa-versa? The Education JCR is available for inspection from the Institute for Scientific Information in Philadelphia or from the National Institute of Education in Washington.

Let me now give you some overall dimensions on the education citation database. The 182 journals from the years 1974 through 1978 contained 58,880 source articles. The total number of references in the database are 442,951. Of these citations, 278,460 went to source journals. Thirty-seven point one percent of the references were directed outside the database itself. Remember here that the central journals from several education related fields were included among the source journals.

The first step in the cluster analysis methodology is to create an individual record containing the bibliographic information form the single source (citing) article and a single reference. Originally, 879,090 source-reference pair records were created. The frequency of co-citations between a reference pair is normalized in terms of the citation frequency of each reference to take into account some very highly cited articles that tend to be co-cited with a wide variety of literature. If the co-citation frequency was not normalized, the very highly cited articles will tend to pull all the references together into one big cluster. In our initial clustering we used a citation frequency of 5 or higher, over the 5 year period, and a normalized co-citation level of 200. A normalized level of 200 means that 20% or more of the citations to each reference were also co-citations of the other reference. However, when the clusters were inspected, it was found that the psychology literature totally dominated the results. This is due both to the size and coherence of the reference lists in psychology. In order to flesh out educational clusters, an additional methodology was employed. A subset of 98 of the 182 database journals was identified that were specialty journals within education. These journals are marked with an asterisk to the left of their number in Figure 1). They comprise slightly over half the original set of source journals. The source-reference pair records for these journals were extracted from the larger database.

Further, references from non-core journals which matched core journal references were also extracted. Since references from the core journals are education related, this method has the effect of excluding most of the non-core journal references that are not related to education. Included in this new database were all the core journal references together with those non-core journal references that also appeared in core journals. Of the original 879,090 source-reference pairs, 404,063 or 46% remained after extraction. A citation threshold of nine or more citations in the five year period was employed. This reduced the number of source-reference pairs to 146,688 or 36% of the slightly over 400,000 pairs extracted by this method. There were 6,881 unique references cited 9 or more times in the journals during the period. A normalized co-citation level of 210 was applied where at least 21% of each reference's citation were co-citations to the other reference. There were 4720 reference pairs that were co-cited at this level or higher. The cluster analysis of the education database produced 565 clusters. There were 81 unique references in the largest cluster.

By inspecting the titles of the sets of source articles corresponding to each cluster, tenative titles were assigned to the educational clusters. Such titles are tenative because they were assigned by me from source article titles without having any claim to expert knowledge in reading research. However, it has been our experience that major substantive differences in cluster titles have rarely been observed when such titles are independently assigned by experts. The titles of the clusters involved with reading are shown in Figure 2. There were 33 reading clusters out of the 565 clusters produced. The clusters are ranked by the column on the far left which is the number of source articles they contained that contributed at least two references each to the cluster. The three largest reading clusters contained between 45 and 55 source articles each during the five year period. The remaining 30 clusters each contain substantially less source articles, 21 articles or less. Nine of the reading clusters, 27% of the total, contain 3 or 4

source articles. In terms of the number of cited references, these clusters are very small. Twenty-seven of the 33 clusters, 82%, have only 2 or 3 unique references. The three largest clusters in terms of source articles also had the largest number of unique references.

The second column on the left of Figure 2 shows the concentration of the core education journals among the source articles. On the average 53.7% of the source articles for a reading cluster come from the core education journals. The three largest clusters, in terms of the number of citing articles, range from 46% to 19% in the proportion of their references coming from the education core.

We will now look at a map showing the relationships between the reading clusters. Figure 3 shows this macromap linking the clusters. Each line drawn between a pair of clusters means that three or more citing articles have references in each of the clusters. A standard MD-scale map is employed using the number of source articles with references in both clusters as a measure of similarity. This map generated from the set of clusters listed in Figure 2 is a bit unusual in my experience in that all of these small clusters did link up into a larger pattern. In many such cases a high proportion of clusters would be isolated and would not link together. The observed picture indicates that if a lower co-citation threshold were used, some of these clusters would merge together. Since the cluster analysis of the education database was completed before I was approached to give this talk, the normalization thresholds were not set to optimize the reading cluster results. A researcher should always be aware in using multivariate statistics that certain parameters are user specified and how these are set depends on the purposes of the researcher. Different values give, at times, rather different results. Since clusters are positioned on the map due to shared source articles, it is useful to look for similar subject areas in a space so arranged. Note here that this is a two-dimensional map. The stress value, for those interested, went from .063 in a three-dimensional map to .092 for 2 dimensions, a rather insignificant increase. However, maps with a different number of dimensions will show different subject area spaces. At any rate, on the two-dimensional map some subject area

patterning is observed, but boundaries are rather blurred. For example, at the bottom are a couple of auditory-perceptual skill clusters. A band of clusters stretching across the lower two quadrants concerns early reading and its interface with oral and visual behaviors. But, in this right hand area, just below and above the horizontal line, are also two little pockets concerning textual endcoding and phonetics. The band of clusters above this line extending across the upper two quadrants concerns textual transformation and comprehension. Arcing across the top of the upper right quadrant are a variety of clusters concerning word and sentence perception. Finally, a little pocket appears in the upper left quadrant concerning Fry's readability index. However, these subject areas are still fairly rough. More coherent areas might be produced by using a greater number of dimensions. Notice also that the densest set of linkages are curved between clusters E, F, B, C, X, and A which cut across subject area boundaries. When using more than two dimensions, several maps have to be inspected simultaneously, however.

MDS can also be applied to mapping the relations between individual cited articles within a cluster. Time permitting, I will illustrate this technique, with three clusters chosen from our list of reading clusters. The first cluster we will look at is the second largest, Question Insertion and Textual Comprehension. Here we find a dispersal pattern typical of a cluster of this size. Figure 4 lists the first author, title, year of publication, and map letter for each reference in the cluster. Each pair of references connected above the co-citation threshold is indicated by a line connecting the points on the map. Figure 5 shows the map. As in the macromap clusters, this map is two-dimensional. The stress value for this map increased from .01 in 3 dimensions to .029 in 2 dimensions. The same qualifications discussed with the macromap apply for this map and common subject areas may be sought. Notice that the co-citation level used for clustering looks about right for this cluster. Two concentrations of links appear: one immediately left of center and the other to the right of the center. However, neither concentration shows an excessive number of links relative to the peripheral references.

The subject matter is rather uniformly dispersed at least as indicated by the reference titles. The references in the upper right appear to concern the type of question asked in relation to prose material. But similar references are dispersed elsewhere in the cluster. The concentration in the lower left of center region seems more concerned with passage length and question position, but again some references of this type appear elsewhere. References concerning mathagenic effects appear in the upper left quadrant although one such reference, E, appears in the lower left.

The largest cluster in terms of the number of citing articles, cluster 71, actually contains about half the number of cited references, 12, found in the cluster we just inspected (which contains 21 references). A list of references for this cluster, which includes the largest number of source articles, is shown in Figure 6. It concerns word perception and cognition and many of the references are from the psychology literature. Figure 7 shows the two-dimensional map; here the stress value increases from .01 in three dimensions to .018 in two dimensions. As before, references connected above the co-citation threshold have lines drawn between them. Here, in part, because of the fewer references on the map, we do not see concentrations of links. In all liklihood the cluster would break apart if a much higher co-citation level were used. Cluster 26, on the other hand, which we just previously looked at, would probably break into two smaller clusters indicated by the two concentrations of linkages. Returning to cluster 71 shown in Figure 7, we find Letter Identification and Word Perception, subjects most closely allied to psychology, generally observed in the lower half of the map. References more directly concerned with reading ability appear in the upper half. These include redunancy in reading, the use of meaningful materials, syllable and word recognition (as distinct from letter recognition). Notice that reference L, Processes in Word Recognition, does not appear on the map. This is because it has the same exact position as reference H, Perceptual Recognition as a Function of the Meaningfulness of Stimulus Material.

As a final example of a co-citation map, we turn to a smaller cluster which concerns Dialect in Reading. A list of references for cluster 296 appears in Figure 8. Here is another type of cluster, one where references are connected by sequential links. The two dimensional map has a stress value of .004 vs. .005 for the three dimensional version. In terms of subject area, with so few references, there is little to be said about subject area concentrations. One work at the far left of the map appears to be about the general question of dialect among blacks. Two others (B) on the lower left and (E) on the upper right, concern dialect in the barriers to reading comprehension. Two others, A and C, whose titles were unfortunately unavailable, concern teaching English and presumably reading.

In conclusion, I hope that this talk introduced some of the techniques available from citation and co-citation analysis for charting the intellectual structure of education related specialization using data from the education citation index. At the same time I did not attempt to gloss over the problems in trying to analyze data from the general statistical runs when applied to the purpose of studying reading specialties without having design statistical runs with this purpose in mind. Thus, while the data presented here gives some idea of how the intellectual structure of the reading literature can be probed with co-citation analysis, an in depth study would find it necessary to fine tune the statistical analysis in order to present the most coherent account of this literature.

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Cole, J.R. and Cole, S., Social Stratification in Science, Chicago: University of Chicago Press, 1973.

Drew, D.E. and Karpf, R., "Ranking Academic Departments: Empirical Findings and a Theoretical Perspective," Research in Higher Education, 14, 305-320, 1981.

Smart, J.C. and Elton, C.F., "Structural Characteristics and Citation Rates of Education Journals," presented at the Annual Meeting of the Society for the Social Studies of Science, Atlanta, Ga., November 1981.

Small, H., "A Co-Citation Model of a Scientific Specialty: A Longitudinal Study of Collagen Research," Social Studies of Science, 7, 139-166, 1977.

Core journals for two-pass extraction

Journals added to ISI Database

Figure 1

Journals In NIE Data Base With 11 Character Abbreviations

1. AAUP Bulletin; AAUP B
2. Acta Psychologica; ACT PSYCHOL
3. Administrative Science Quarterly; ADM SCI QUA
* 4. Adult Education; ADULT ED-W
* 5. Alberta Journal of Educational Research; ALBR J EDU
6. American Economic Review; AM ECON REV
* 7. American Educational Research Journal; AM EDUC RES
8. American Journal of Mental Deficiency; AM J MENT D
9. American Journal of Orthopsychiatry; AM J ORTHOP
10. American Journal of Psychiatry; AM J PSYCHI
11. American Journal of Psychology; AM J PSYCHO
12. American Journal of Public Health; AM J PUB HE
13. American Journal of Sociology; AM J SOCIOL
14. American Political Science Review; AM POLI SCI
15. American Psychologist; AM PSYCHOL
16. American Sociological Review; AM SOCIOL
17. Archives of General Psychiatry; ARCH G PSYC
* 18. Audio/Visual Instruction; AUDIOVIS IN
19. Behaviour Research and Therapy; BEHAV RES
20. Behavioral Science; BEHAV SCI
* 21. British Journal of Educational Studies; BR J EDUC S
* 22. Change Magazine; CHANGE MAG
* 23. Child Care Quarterly; CHILD CARE
* 24. Child Development; CHILD DEV
* 25. Childhood Education; CHILDHD ED
26. Child Study Journal; CHILD ST J
27. Child Welfare; CHILD ST J

28. Cognitive Psychology; COG PSYCHOL
* 29. College and University Bulletin; COLL UNIV
* 30. College English; COLL ENGL
31. Columbia Journalism Review; COLUMB JOUR
* 32. Communication Education; COMMUN EDUC
* 33. Comparative Education; COMP EDUC
* 34. Comparative Education Review; COMP EDU RE
* 35. Contempory Education; CONT EDUC
* 36. Counselor Education and Supervision; COUNS ED SU
37. Developmental Psychology; DEVEL PSYCH
* 38. Early Childhood Education; EAR CHIL ED
* 39. Education; EDUCATION
* 40. Education and Urban Society; EDUC URBAN
* 41. Educational Administration Quarterly; EDUC ADMIN
* 42. Educational and Psychological Measurement; EDUC PSYC M
* 43. Educational Forum; EDUC FORUM
* 44. Educational Leadership; EDUC LEADER
* 45. Educational Psychologist; EDUC PSYCHO
* 46. Educational Record; EDUC REC
* 47. Educational Research; EDUC RES
* 48. Educational Review; EDUC REV
* 49. Educational Technology; EDUC TECH
* 50. Educational Theory; EDUC THEORY
* 51. Elementary English; ELEM ENGL
* 52. Elementary School Guidance; ELEM SCH G
* 53. Elementary School Journal; ELEM SCH J
* 54. English Journal; ENGLISH J
* 55. English Language Teaching Journal; ENG LA T J
* 56. Exceptional Children; EXCEPT CHIL

* 57. Foreign Languages Annals; FOREIGN LAN

58. Harvard Business Review; HARV BUS RE

59. Harvard Civil Rights-Civil Liberties Law Review; HARV CIV RI

* 60. Harvard Educational Review; HARV EDU RE

61. Harvard Law Review; HARV LAW RE

* 62. Health Education; HEALTH EDUC

* 63. Higher Education Review; HIGH EDUC R

* 64. History of Education Quarterly; HIST EDUC Q

65. Human Development; HUMAN DEV

66. Human Relations; HUMAN RELAT

* 67. Improving College and University Teaching; IMP COL U T *

68. Improving Human Performance Quarterly; IMPR HUM P

* 69. Instructional Science Quarterly; INSTR SCI

* 70. Interchange: A Journal of Educational Studies; INTERCHANGE

71. International Journal of Early Childhood; INT J EAR C

* 72. International Review of Education; INT REV EDU

73. Journal of Abnormal Psychology; J ARN PSYCH

* 74. Journal of Aesthetic Education; J AESTHET E

75. Journal of American College Health Association; J AM COLL H *

76. Journal of Applied Behavior Analysis; J APPL BE A

77. Journal of Applied Behavioral Science; J APPL BEH

78. Journal of Applied Psychology; J APPL PSYC

79. Journal of Child Language; J CHILD LAN

80. Journal of Child Psychology and Psychiatry; J CHILD PSY

81. Journal of Clinical Psychology; J CLIN PSYC

* 82. Journal of College Student Personnel; J COLL STUD

83. Journal of Communication; J COMM

84. Journal of Consulting and Clinical Psychology; J CONS CLIN

* 85. Journal of Cooperative Education; J COOP ED *

86. Journal of Counseling Psychology; J COUN PSYCH

87. Journal of Creative Behavior; J CREAT BEH

* 88. Journal of Dental Education; J DENT ED

* 89. Journal of Economic Education; J ECON EDUC

* 90. Journal of Educational Administration; J EDUC ADM

* 91. Journal of Educational Measurement; J EDUC MEAS

* 92. Journal of Educational Psychology; J EDUC PSYC

* 93. Journal of Educational Research; J EDUC RES

94. Journal of Employment Counceling; J EMPL COUN

95. Journal of Experimental Child Psychology; J EXP C PSY

* 96. Journal of Experimental Education; J EXP EDUC

97. Journal of Experimental Psychology; J EXP PSYCH

98. Journal of Experimental Social Psychology; J EXP S PSY

* 99. Journal of Extention; J EXT

* 100. Journal of General Education; J GEN EDUC

101. Journal of General Psychology; J GEN PSYCH

102. Journal of Geography; J GEOGR

* 103. Journal of Higher Education; J HIGH EDUC

104. Journal of Human Resources; J HUM RES

* 105. Journal of Law and Education; J LAW EDUC

* 106. Journal of Learning Disabilities; J LEARN DI

* 107. Journal of Legal Education; J LEG EDUC

108. Journal of Marriage and the Family; J MARRIAGE

109. Journal of Mathematical Psychology; J MATH PSYC

* 110. Journal of Medical Education; J MED EDUC

* 111. Journal of Negro Education; J NEGRO ED

112. Journal of Personality; J PERSONAL

113. Journal of Personality and Social Psychology; J PERS SOC

114. Journal of Political Economy; J POLIT EC

115. Journal of Psychology; J PSYCHOL

* 116. Journal of Reading; J READING

* 117. Journal of Reading Behavior; J READ BEH

* 118. Journal of Research and Development in Education; J RES DEV E

* 119. Journal of School Health; J SCH HEALT

* 120. Journal of School Psychology; J SCH PSYCH

121. Journal of Social Issues; J SOC ISSUE

122. Journal of Social Psychology; J SOC PSYCH

* 123. Journal of Special Education; J SPEC EDUC

* 124. Journal of Teacher Education; J TEACH EDU

125. Journal of The College and University Personnel Association; J COLL UNIV

126. Journal of the Experimental Analysis of Behavior; J EX AN BEH

127. Journal of Verbal Learning and Verbal Behavior; J VERB LEAR

* 128. Journal of Vocational Behavior; J VOCAT BEH

129. Journalism Quarterly; JOURN Q

130. Language; LANGUAGE

* 131. Language Arts; LANG ARTS

* 132. Language Learning; LANG LEARN

* 133. Measurement and Evaluation in Guidance; MEAS EVAL G

134. Merrill-Palmer Quarterly; MERRILL-PAL

* 135. Modern Language Journal; MOD LANG J

136. Monographs of the Society for Research in Child Development; MON S RES C

137. Multivariate Behavioral Research; MULTIV BE R

* 138. New Directions for Community Colleges; NEW DIR COM

* 139. New Directions for Higher Education; NEW DIR HIG

* 140. NSPI Journal; NSPI J

141. Organizational Behavior and Human Performance; ORGAN BEH H

* 142. Peabody Journal of Education; PEABODY J E

143. Perceptual and Motor Skills; PERC MOT SK

144. Perception and Psychophysics; PERC PSYCH

* 145. Personnel and Guidance Journal; PERS GUID J

* 146. Phi Delta Kappan; PHI DEL KAP

* 147. Philosophy of Education Society Proceedings; PHIL ED S P *

* 148. Programmed Learning and Educational Technology; PROG LEARN

* 149. Prospects: Quarterly Review of Education; PROSPECT

150. Psychological Bulletin; PSYCHOL B

151. Psychological Reports; PSYCHOL REP

152. Psychological Review; PSYCHOL REV

* 153. Psychology in the Schools; PSYCHOL SCH

154. Psychology Today; PSYCHOL TOD

155. Psychometrika; PSYCHOMETRI

156. Public Administration Review; PUBL ADM RE

157. Public Interest; PUBL INTER

158. Public Opinion Quarterly; PUBI OPIN Q

159. Quarterly Journal of Speech; Q J SPEECH

* 160. Reading Research Quarterly; READ RES Q

* 161. Reading Teacher; READ TEACH

162. Research Quarterly; RES QUART

* 163. Review of Educational Research; REV EDUC RE

* 164. School Review; SCH REV

165. Science; SCIENCE

* 166. Social Education; SOCIAL EDUC

167. Social Forces; SOCIAL FORC

168. Social Problems; SOCIAL PROB

* 169. Social Studies; SOCIAL STUD

170. Social Work; SOCIAL WORK

171. Sociology of Education; SOCIOL EDUC

* 172. Teachers College Record; TEACH COL R

* 173. Teaching of Psychology; TEACH PSYCH

* 174. Teaching Political Science; TEACH POL S

* 175. Teaching Sociology; TEACH SOCIO

* 176. Tesol Quarterly; TESOL QUART

* 177. Theory & Research in Social Education; TH RES S ED *

178. Training and Development Journal; TRAIN DEV J

* 179. Urban Education; URBAN EDUC

* 180. Vocational Guidance Quarterly; VOCAT GUID

181. Wilson Bulletin; WILSON B

* 182. Young Children; YOUNG CHILD

Figure 2

Reading Clusters in NIE Two Pass Extraction File
1974-1978

Cluster Number	Map Identification Letter	Education Core* Journals Source Article Concentration	Title	Number of Unique Cited References	Number of Source Articles with 2+ References to Cluster
71	B	19.4%	Word Perception and Cognition	12	55
26	A	46.2%	Question Insertion and Textual Comprehension	21	49
91	E	36.3%	Auditory-Visual Integration and Reading	20	46
248	J	68.3%	Comprehension and Concept Formation in Reading	2	21
323	S	91.2%	Fry Readability Graph and Reading Cue Utilization	2	16
311	P	62.0%	Readability Indexes	4	16
433	X	36.8%	Reading Ability and Memory	2	11
72	C	23.3%	Phonenic Recoding in Reading	3	11
114	G	25.0%	Rhythm, Syntax and Sentence Perception in Reading	3	11
480	3	48.1%	Word Recognition in Young Children	2	9
348	U	18.7%	Reading Comprehension and Picture-Word Interference	2	9
293	M	11.8%	Vocalization and Reading	3	9
314	R	11.5%	Word Perception	2	9

Figure 2 (cont.)

Cluster Number	Map Identification Letter	Education Core* Journals Source Article Concentration	Title	Number of Unique Cited References	Number of Source Articles with 2+ References to Cluster
118	H	57.9%	Phonemic and Synthetic Word Recognition in Reading	2	8
312	Q	55.9%	Readability	2	8
344	T	88.2%	Auditory Perceptual Skills and Reading	2	7
73	D	100.0%	Early Instruction and Reading	2	7
100	F	64.5%	High Frequency Words and Mis-reading	5	7
282	L	66.7%	Auditory Discrimination and Reading	2	6
224	I	83.3%	Textual Transformation and Readability	2	6
296	N	83.3%	Dialect and Reading	5	6
459	Z	0.0%	Word Perception and Reading Ability	2	5
523	6	83.3%	Passage Dependency	2	5
476	2	57.1%	Reading Instruction and Phoentics	2	5
441	Y	18.7%	Text Organization and Encoding	2	4
417	W	88.2%	Cross-Cultural and Sex Differences in Reading	2	4
307	O	21.4%	Reading and Context Clues	2	4
503	5	57.1%	Reading Reversals	2	4

Figure 2 (cont.)

Cluster Number	Map Identification Letter	Education Core* Journals Source Article Concentration	Title	Number of Unique Cited References	Number of Source Articles with 2+ References to Cluster
549	7	42.9%	Semantic Context in Reading	2	4
470	1	87.0%	Reading, Oral Language and Writing	2	3
397	V	80.0%	Kindergarten Reading	2	3
279	K	75.0%	Early Reading Environment	2	3
481	4	64.5%	Generative Model of Reading	2	3

Figure 3
Macro-Cluster Map

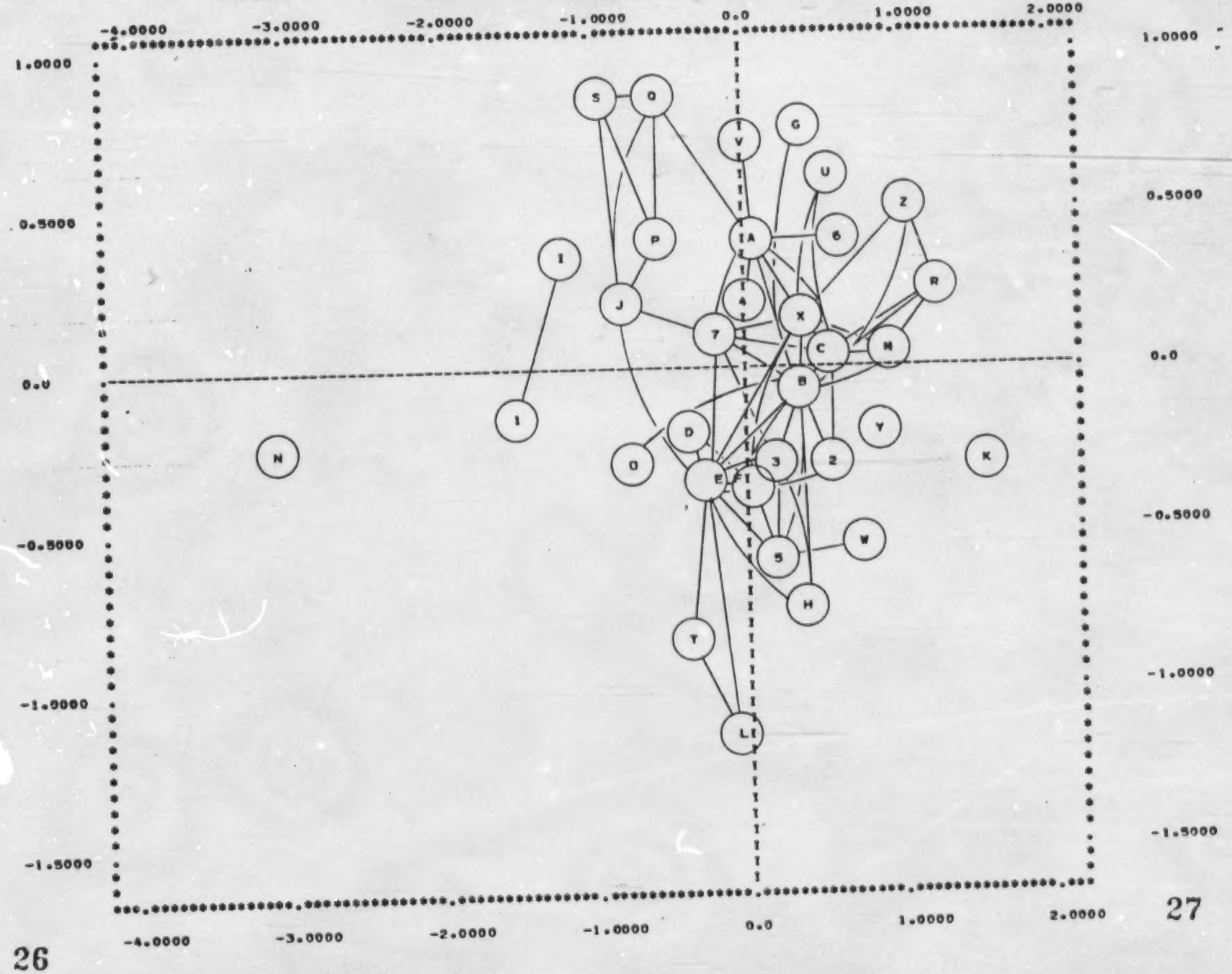


Figure 4

Cluster 26 Cited Reference List

Map Letter	Author	Title	Year
A	Anderson RC	(*Psychological Learning)	1976
B	Burning RH	Effects of Review and Testlike Events Within the Learning of Prose Materials	1968
C	Carver RP	Critical Review of Mathemagenic Behaviors and the Effect of Questions Upon Retention of Prose Materials	1972
D	Felker DP	Effects of Question-Type and Question-Placement on Problem-Solving Ability from Prose Material	1975
E	Frase LT	Some Data Concerning the Mathemagenic Hypothesis	1968
F	Frase LT	Learning from Prose Materials: Length of Passage, Knowledge of Results and Position of Questions	1967
G	Frase LT	Some Unpredicted Effects of Different Questions Upon Learning From Connected Discourse	1968
H	Frase LT	Effect of Question Location, Pacing and Mode Upon Retention of Prose Material	1968
I	Frase LT	Effect of Question Position and Frequency Upon Learning From Text Under Different Levels of Incentives	1970
J	Frase LT	Effect of Incentive Variables and Type of Adjunct Question Upon Text Learning	1971
K	Frase LT	Boundary Conditions for Mathemagenic Behavior	1970
L	Ladas H	Mathemagenic Effects of Factual Review Questions on Learning of Incidental Information	1973
M	McGaw B	Direction of Effect of Questions in Prose Material	1972
N	Rickards JP	Type and Frequency of Questions in Processing Textual Materials	1974
O	Rothkopf EZ	Indirect Review and Priming Through Questions	1974

Figure 4 (cont.)

Map Letter	Author	Title	Year
P	Rothkopf EZ	Concept of Mathemagenic Activities	1970
Q	Rothkopf EZ	(*American Education Research)	1966
R	Rothkopf EZ	Selective Facilitative Effects of Interspensed Questions on Learning From Written Materials	1967
S	Schavelson RJ	Effects of Position and Type of Question on Learning From Prose Material--Interaction of Treatment With Individual Differences	1974
T	Washburne JW	The Use of Questions in Social Science Material	1929
U	Watts GH	Effects of Three Types of Inserted Questions on Learning From Prose	1971

*Title Unavailable

Figure 5

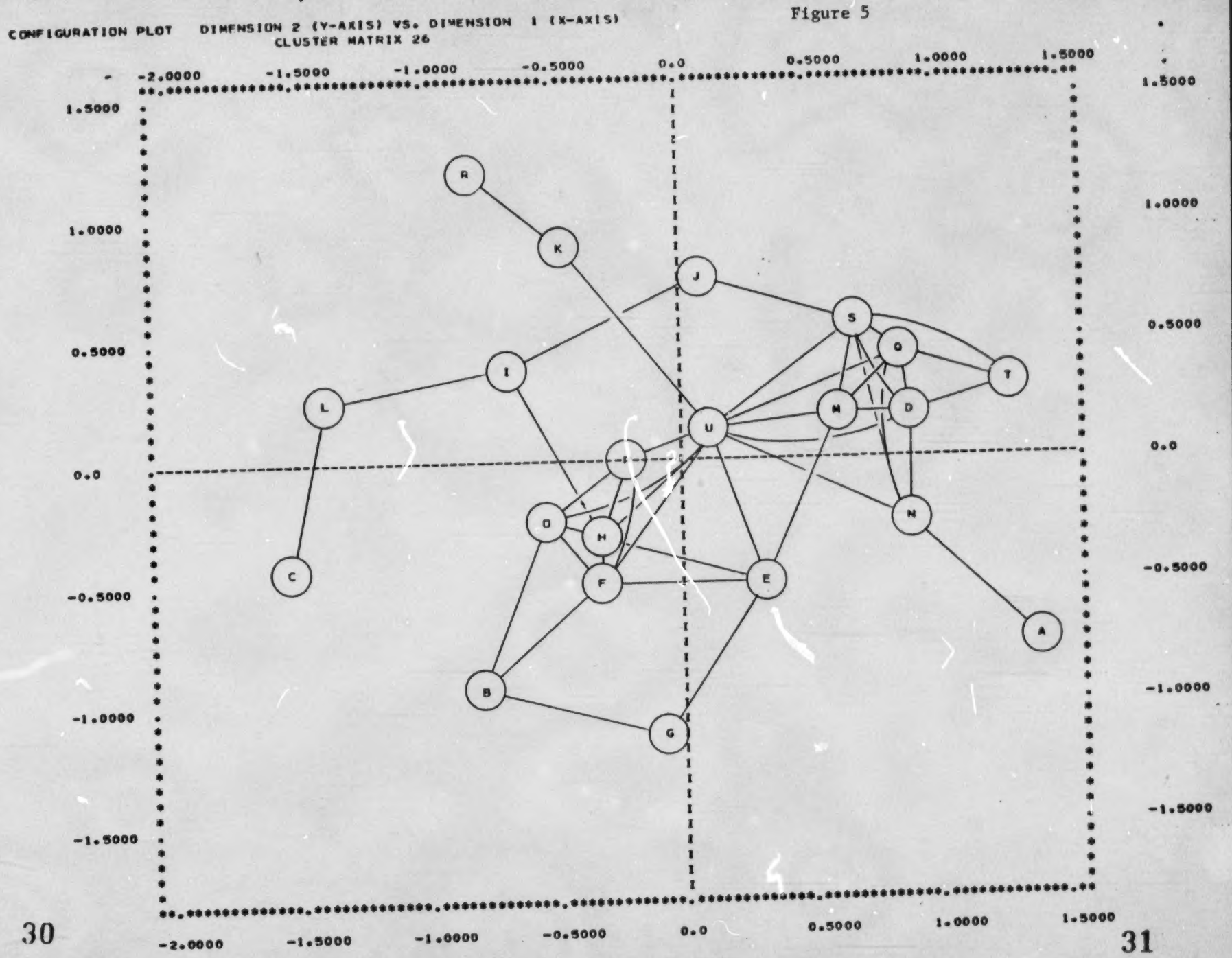

CONFIGURATION PLOT DIMENSION 2 (Y-AXIS) VS. DIMENSION 1 (X-AXIS)
CLUSTER MATRIX 26
-2.0000
-1.5000
-1.0000
-0.5000
0.0
0.5000
1.0000
1.5000
R
K
J
S
O
T
I
L
U
M
D
Q
H
N
C
F
E
A
B
G

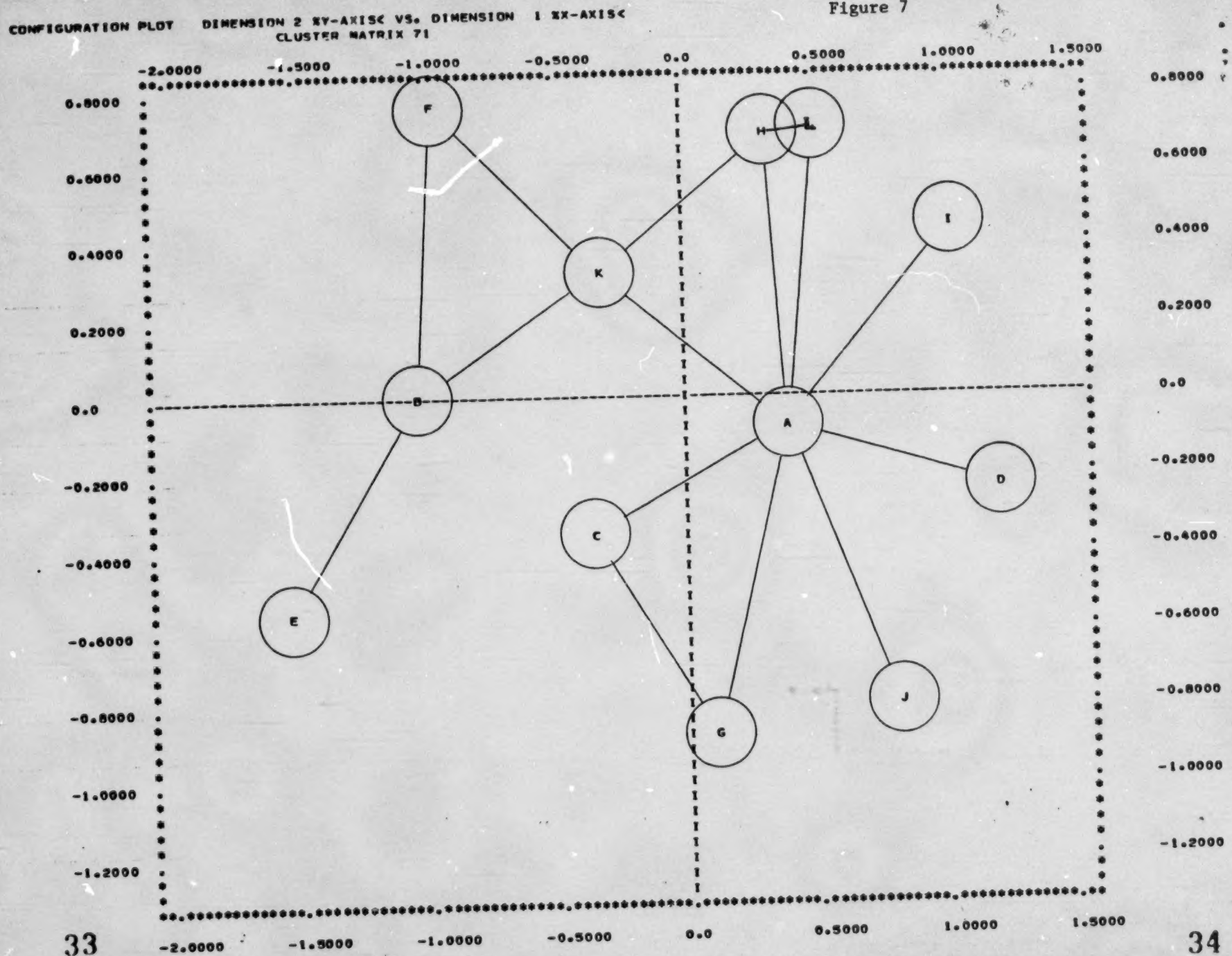
Figure 6

Cluster 71 Cited Reference List

Map Letter	Author	Title	Year
A	Baron J	Analysis of Word Superiority Effect	1973
B	Estes WK	Locus of Inferential and Perceptual Processes in Letter Identification	1975
C	Gibson EJ	The Role of Gramme-Phoneme Correspondence in the Perception of Words	1962
D	Gibson EJ	(*Basic Studies in Reading)	1970
E	Krueger LE	Familiarity Effects in Visual Information Processing	1975
F	Mason M	Reading Ability and Letter Search Time Effects of Orthographic Structure Defined by Single Letter Positional Frequency	1975
G	Miller GA	Familiarity of Letter Sequences and Tachistoscopic Identification	1954
H	Reicher GM	Perceptual Recognition as a Function of Meaningfulness of Stimulus Material	1969
I	Spoehr KT	Roles of Syllables in Perceptual Processing	1973
J	Spoehr KT	Role of Orthographic and Phontactic Rules in Perceiving Letter Patterns	1975
K	Thompson MC	Visual Information and Redundancy in Reading	1973
L	Wheeler DD	Processes in Word Perception	1970

* Title Unavailable

Figure 7


CONFIGURATION PLOT DIMENSION 2 <Y-AXIS> VS. DIMENSION 1 <X-AXIS>
CLUSTER MATRIX 71
-2.0000
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-1.0000
-0.5000
0.0
0.5000
1.0000
1.5000
0.8000
0.6000
0.4000
0.2000
0.0
-0.2000
-0.4000
-0.6000
-0.8000
-1.0000
-1.2000
F
H
L
I
K
B
A
D
C
E
J
G

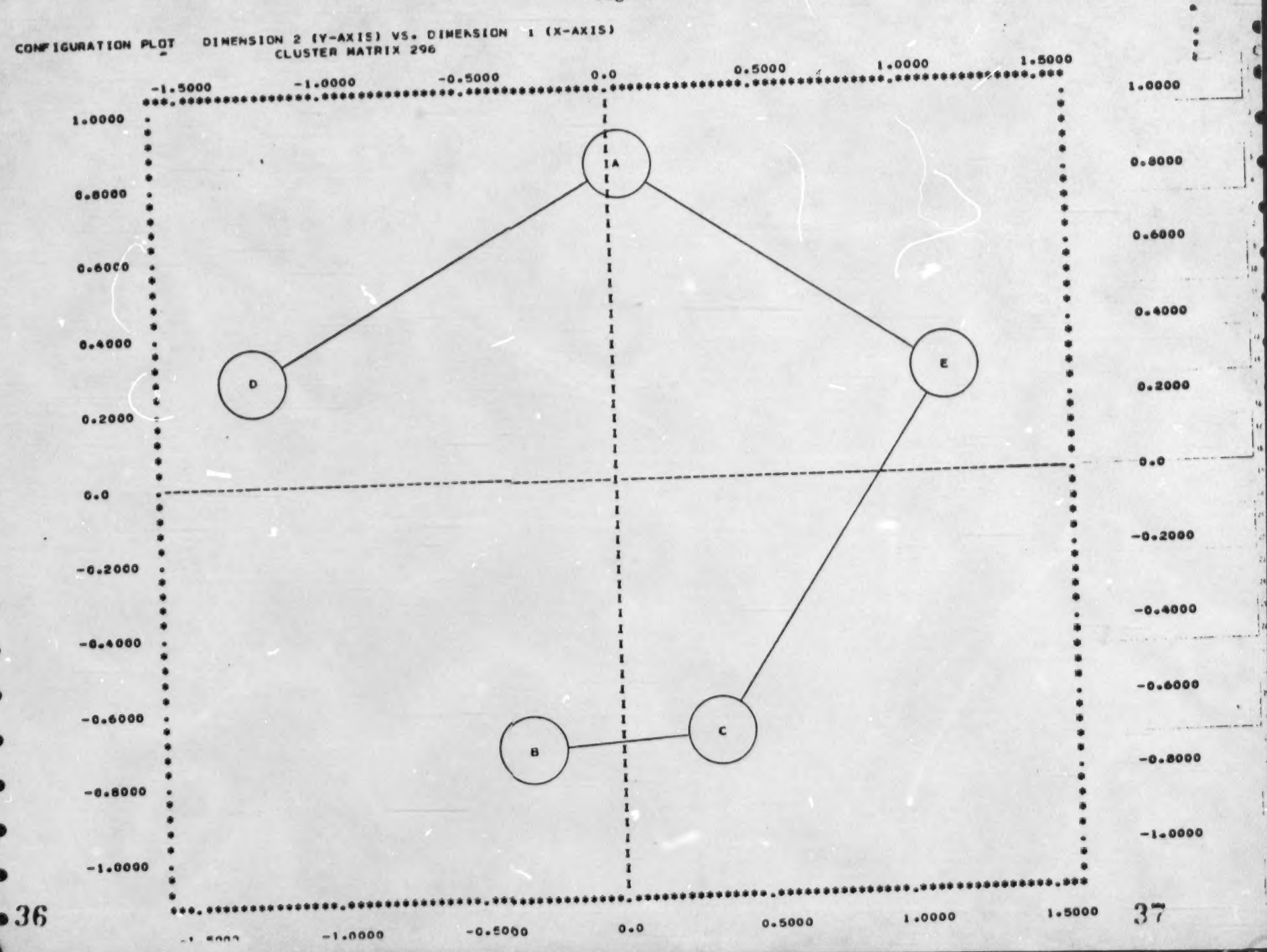
Figure 8

Cluster 296 Cited Reference List

Map Letter	Author	Title	Year
A	Fasold RW	(*Teaching Standard Eng)	1970
B	Goodman KS	Dialect Barriers to Reading Comprehension	1965
C	Labov V	(*New Directions Elem)	1967
D	Sledd J	Bi-Dialectalism-Linguistics of White Supremacy	1969
E	Venesky RL	Nonstandard Language and Reading	1970

*Title Unavailable

Figure 9


CONFIGURATION PLOT DIMENSION 2 (Y-AXIS) VS. DIMENSION 1 (X-AXIS)
CLUSTER MATRIX 296
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0.0
0.5000
1.0000
1.5000
1.0000
0.8000
0.6000
0.4000
0.2000
0.0
-0.2000
-0.4000
-0.6000
-0.8000
-1.0000
A
B
C
D
E